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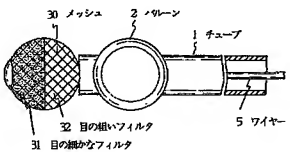
(71)出願人　592190763
デュアー，エドワード．イーンド
兵庫県西宮市甲陽園目神山町31番2号
(72)発明者　デュアー，エドワード．イーンド
兵庫県西宮市甲陽園目神山町31番2号

(54)【発明の名称】　血栓除去カテーテル

(57)【要約】
【目的】バルーンと血管内壁との間から漏出した血栓片を捕集して体外に排出する。
【構成】バルーンカテーテルに膨張可能フィルタを追加してバルーン周辺から漏出した血栓片を捕集して体外に排出する。



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【特許請求の範囲】

【請求項1】　フレキシブルなチューブと、該チューブの先端部付近の外面に設けられた膨張収縮自在なバルーンとよりなるバルーンカテーテルにおいて、該チューブの内部に収容可能な自己膨張性フィルタが設けられ、該フィルタの先端部は、該チューブの内径と同じ最大直径の外方に向かう半球状部材と接続し、該フィルタの後端部は該チューブに内挿されたフレキシブルなワイヤーと接続し、該フィルタは先端部に向かって凸状となった目の細かなフィルタと、該目の細かなフィルタの基端の最大径部と接続する目の粗いフィルタとよりなり、該チューブを基準として該ワイヤーの前進により、該自己膨張性フィルタが該チューブの先端部から押し出されて膨張し、血管内壁と当接することを特徴とする血栓除去カテーテル。

【請求項2】　該自己膨張性のフィルタが球状の目の粗い弾性メッシュをベースとし、該メッシュの前半部が目の細かなフィルタ材料により完璧され、該メッシュの後半部自体が該目の粗いフィルタであることを特徴とする請求項1記載の血栓除去カテーテル。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は血栓除去カテーテルに関する。詳しくは、血管内に挿入し、バルーンを膨張させてからチューブを後退させて血栓を体外に排出するのに使用されるバルーンカテーテルの改良に関するものであり、該チューブの後退時に該バルーンの周辺から血流方向に漏出する血栓片を捕集して体外に排出する血栓除去カテーテルに関する。

【0002】

【従来の技術】従来のバルーンカテーテルは内壁に血栓が付着した血管内に挿入してからバルーンを膨張させ、血管内壁と当接させた状態で該カテーテルを引き出すことにより血栓を除去していた。

【0003】

【発明が解決しようとする課題】上記のバルーンカテーテルによる血栓除去に際して、少量の血栓片が膨張したバルーンの周辺から漏出して血管内の下流方向に流れることがあった。特に静脈からの血栓除去時に少量であっても剥離した血栓片が血管の下流方向に流れると、心臓を経て肺動脈塞栓を生じる危険性があり、場合によって患者が死亡することがあった。

【0004】

【課題を解決するための手段】上記の課題を解決するために、本発明の血栓除去カテーテルはフレキシブルなチューブと、該チューブの先端部付近の外面に設けられた膨張収縮自在なバルーンとよりなるバルーンカテーテルにおいて、該チューブの内部に収容可能な自己膨張性フィルタが設けられる。該フィルタの先端部は該チューブの内径と同じ最大直径の外方に向かう半球状部材と接続

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し、該フィルタの後端部は該チューブに内挿されたフレキシブルなワイヤーと接続する。該フィルタは先端部に向かって凸状となった目の細かなフィルタと、該目の細かなフィルタの基端の最大径部と接続する目の粗いフィルタとよりなる。該チューブを基準とした該ワイヤーの前進により、該自己膨張性フィルタが該チューブの先端部から押し出されて膨張して血管内壁と当接する。

【0005】

【作用】本発明の該自己膨張性のフィルタを内挿した血栓除去カテーテルを内壁に血栓が付着した血管内に挿入してバルーンを膨張させてからワイヤー前進させて該自己膨張性フィルタを該バルーンカテーテルの前端から離脱させるか、あるいは該自己膨張性フィルタを離脱させてから該バルーンを膨張させると、該バルーンと該自己膨張性フィルタが該血管の内壁に当接する。該バルーンと、該自己膨張性フィルタが該血管の内壁に当接した状態で本発明の血栓除去カテーテルを後退させると血栓は該バルーンによって体外に除去され、該バルーンから漏出した少量の血栓片は該目の粗いフィルタを通過して該目の細かなフィルタによって捕集されて体外に排出される。あるいは、血管の状態に応じて自己膨張性フィルタを血管内壁に当接させた状態で留置して、該チューブのみを後退させると血管内壁に付着している血栓が該バルーンによって体外に除去される。該血栓除去時に該バルーンと血管内壁との間から漏出して下流方向に流れた血栓片は該目の粗いフィルタを通過して該目の細いフィルタによって捕捉される。該バルーンによって血栓が体外に除去されたら、該バルーンを収縮させてから該チューブを前進させて該フィルタと当接させ、該ワイヤーを引っ張って該フィルタを該チューブ内に収容し、該チューブを体外に取り出すと、該フィルタによって捕捉された血栓片も除去される。

【0006】

【実施例】以下、本発明の血栓除去カテーテルの実施例を図面を参照して説明する。第1図は該チューブ内に該フィルタを収容し、該バルーンが収縮した状態を示す該血栓除去カテーテルの要部の一部切欠側面図、第2図は該フィルタを該チューブから前方に押し出し、該バルーンを膨張させた状態を示す該血栓除去カテーテルの要部の一部切欠側面図である。第1図において、該血栓除去カテーテルは、フレキシブルなチューブ1と、該チューブの先端部付近の外面に設けられた膨張収縮自在なバルーン2とよりなるバルーンカテーテルにおいて、該チューブ1の内部に収容可能な自己膨張性フィルタ3が設けられる。該フィルタ3の先端部は該チューブ1の内径と同じ最大直径の外方に向かう半球状部材4と接続し、該フィルタ3の後端部は該チューブに内挿されたフレキシブルなワイヤー5と接続する。該フィルタ3は、先端部に向かって凸状となった目の細かなフィルタ31と、該目の細かなフィルタ32の基端部の最大径部と接続す

る目の粗いフィルタ３２とよりなり、該チューブ１を基準とした該ワイヤー５の前進により、該自己膨張性フィルタ３は該チューブ１の先端部から押し出され、膨張して図２に示されるように図示されない血管内壁と当接する。該フレキシブルチューブ１は例えば一般のカテーテルに使用されているプラスチック製である。該膨張収縮自在なバルーン２は例えば生体適合性に優れた天然ゴム製であって、該チューブ１の内厚内の図示されないルーメンを経て該チューブの基端部に設けられた図示されないポートに連通し、該ポートからの例えば生食の注入によって膨張可能であり、また該生食の排出によって収縮可能である。該チューブ１の内径と同じ最大直径の外方に向かう半球状部材４は血液適合性に優れたプラスチック材料、例えばシリコーンによって構成される。該自己膨張性のフィルタ３のベース材料は、好ましくは全体が球状ないし楕円状になった弾性メッシュ３０、例えばナイロンメッシュによって構成される。該目の細かなフィルタ３１は、該メッシュ３０の先端側の内面の半分に、例えば極細の生体適合性に優れたプラスチック製ファイバ、例えばポリエステルファイバを充填するか、あるいは該メッシュ３０の前半部をポリマー溶液に浸漬し、硬化させて該前半部にメンブレンフィルタを形成させたものであってもよい。該目の粗いフィルタ３２は該目の粗いメッシュ３０の後半部自体によって構成される。該フレキシブルなワイヤー５は例えばステンレス鋼製である。本発明の血栓除去カテーテルは第１図に示されるように該フィルタ３を該チューブ１内に収容した状態で血管内に挿入される。該挿入時に、該半球状部材４は該チューブ１の先端部を閉じて、血液が該チューブ１から体外に漏出するのを防止する。第２図は該ワイヤー５の前進によって該フィルタ３が該チューブ１の先端部に押し出され、該バルーンが膨張した状態を示し、該フィルタ３は自己膨張性のため膨張して図示されない血管内壁と当接し、該バルーン２は前記のとおり生食注入によって膨張し血管内壁と当接している。該フィルタ３の押し出しと該バルーン２の膨張はいずれが先であってもよい。本発明の該自己膨張性のフィルタ３を内挿した血栓除去カテーテルを内壁に血栓が付着した血管内に挿入してバルーン２を膨張させてからワイヤー前進させて該自己膨

張性フィルタを該バルーンカテーテルの前端から離脱させるか、あるいは該自己膨張性フィルタ３を離脱させてから該バルーン２を膨張させると、該バルーン２と該自己膨張性フィルタ３が該血管の内壁に当接する。該バルーン２と該自己膨張性フィルタ３が該血管の内壁に当接した状態で本発明の血栓除去カテーテルを徐々に後退させると血栓は該バルーン２によって体外に除去され、該バルーン３と血管内壁との間から漏出した少量の血栓片は該目の粗いフィルタ３２を通過して該目の細かなフィルタ３１の最大径部と血管内壁との間隙によって捕集されて体外に排出される。あるいは、血管内壁の状態に応じて自己膨張性フィルタ３を血管内壁に当接させた状態で留置して、該チューブ１を後退させると血管内壁に付着している血栓が該バルーン３によって体外に除去される。該血栓除去時に該バルーン３と血管内壁との間から漏出して下流方向に流れた血栓片は該目の粗いフィルタ３２を通過して該目の細かなフィルタ３１によって捕捉される。該バルーンによって血栓が体外に除去されたら、該バルーン３を収縮させてから該チューブ１を前進させて該フィルタ３と当接させ、該ワイヤー５を引っ張って該フィルタ３を該カテーテル内に収容し、該チューブ１を体外に取り出すと、該フィルタ３によって捕捉された血栓片も除去される。

【０００７】

【発明の効果】本発明の血栓除去カテーテルは上記のような構成となっているので、バルーンの周辺から漏出した血栓片を完全に捕集して体外に除去することができる。

【図面の簡単な説明】

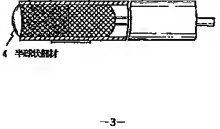
【図１】チューブ内にフィルタを収容した状態を示す血栓除去カテーテルの要部の一部切欠側面図

【図２】フィルタをチューブから前方に押し出し、バルーンを膨張させた状態を示す血栓除去カテーテルの要部の一部切欠側面図

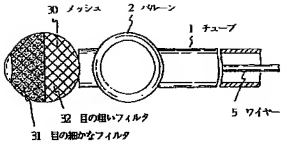
【符号の説明】

１はチューブ、２はバルーン、３はフィルタ、４は半球状部材、５はワイヤー、３０はメッシュ、３１は目の細かなフィルタ、３２は目の粗いフィルタ。

【図１】



【図２】



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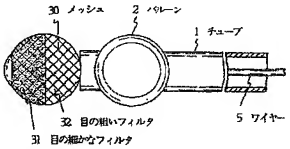
(21) Application No:	H4-237565	(71) Applicant	592190763 Dewar Edward Iindo 31-2 Megamiyama-cho Koshien, Nishinomiya Hyogo-ken
(22) Application Date:	July 22, 1992	(72) Inventor	Dewar Edward Iindo 31-2 Megamiyama-cho Koshien, Nishinomiya Hyogo-ken

(54) [Title of the Invention] Thrombus-removing Catheter

(57) [Abstract]
[Purpose] To catch thrombus pieces that leak out from between the balloon and the inner wall of the blood vessel and discharge them out of the body.
[Constitution] An expandable filter is added to a balloon catheter and the thrombus pieces that leak out from the area around the balloon are caught and discharged from the body.



1 = tube; 2 = balloon; 5 = wire; 30 = mesh; 31 = fine-mesh filter; 32 = course-mesh filter

[Claims]
[Claim 1]

A thrombus-removing catheter comprising a balloon catheter consisting of a flexible tube and a balloon that is inflatably/deflatably provided on the outer surface near the distal end of said tube; wherein a self-expanding filter is provided that can be housed inside of said tube, the distal end of said filter is connected to a semispherical member that faces outward toward the maximum diameter, which is the same as the inner diameter of said tube, the proximal end of said filter is connected to a flexible wire that is inserted into said tube, said filter comprises a fine-mesh filter that forms a convex shape toward its distal end and a course-mesh filter that is connected to the proximal end of said fine-mesh filter at a point where the diameter is the greatest, and said self-expanding filter is pushed out from the distal end of said tube and expanded so that it comes into contact with the inner wall of the blood vessel by advancing said wire using said tube as a basis.

[Claim 2]

The thrombus-removing catheter according to Claim 1, wherein said self-expanding filter has a course-mesh that is elastic and spherical in shape as its base, the front half of said mesh is filled with fine-mesh filter material and the course-mesh filter is actually the rear half of said mesh.

[Detailed Explanation of the Invention]

[0001]

[Industrial Field of Application]

The present invention pertains to a thrombus-removing catheter. More specifically, it pertains to a thrombus-removing catheter that relates to the improvement of a balloon catheter that is inserted into the blood vessel and used to discharge a thrombus outside the body by inflating the balloon and then retracting the tube, wherein the thrombus pieces that leak out from the area around said balloon in the direction in which the blood flows when said tube is retracted are caught and discharged out of the body.

[0002]

[Prior Art]

Conventional balloon catheters were first inserted into the blood vessel in which a thrombus had adhered to its inner wall and then the balloon was inflated and the thrombus was removed by pulling out said catheter while it was still touching the inner wall of the blood vessel.

[0003]

[Problem to be Solved by the Invention]

When removing a thrombus by means of the aforementioned balloon catheter, a small amount of thrombus pieces would leak out from the area around the inflated balloon and flow downstream inside the blood vessel. Particularly when removing thrombus from a vein, even if a small amount of detached thrombus pieces flowed downstream inside the blood vessel, there was a risk that the pieces would reach the heart and cause a pulmonary embolism, and in certain instances, the death of the patient.

[0004]

[Means for Solving the Problem]

In order to solve the aforementioned problem, the thrombus-removing catheter pertaining to the present invention provides a balloon catheter comprised of a flexible tube and an inflatable/deflatable balloon provided on the outer surface near the distal end of said tube, wherein said balloon catheter is provided with a self-expanding filter that can be housed inside of

said tube. The distal end of said filter is connected to a semispherical member that faces outward toward the maximum diameter, which is the same as the inner diameter of said tube and the proximal end of said filter is connected to a flexible wire that is inserted into said tube. Said filter comprises a fine-mesh filter that forms a convex shape toward its distal end and a course-mesh filter that is connected to the proximal end of said fine-mesh filter at a point where the diameter is the greatest. Said self-expanding filter is pushed out from the distal end of said tube and expanded so that it comes into contact with the inner wall of the blood vessel by advancing said wire forward using said tube as a basis.

[0005]

[Operation]

The thrombus-removing catheter into which is inserted the self-expanding filter pertaining to the present invention is either inserted into the blood vessel in which a thrombus has adhered to its inner wall, the balloon is inflated, the wire is then advanced and the self-expanding filter is retracted from the distal end of the balloon catheter, or the self-expanding filter is retracted before the balloon is inflated so that the balloon and the self-expanding filter both come into contact with the inner wall of the blood vessel. If the thrombus-removing catheter pertaining to the present invention is retracted with the balloon and self-expanding filter touching the inner wall of the blood vessel, the thrombus is removed to the outside of the body by the balloon, the small amount of thrombus pieces that leak out from the balloon pass through the course-mesh filter, are caught by the fine-mesh filter and are discharged from the body. Or, the self-expanding filter is placed in accordance with the state of the blood vessel and left so that it is touching the inner wall of the blood vessel and only the tube is retracted so as to discharge the thrombus that has adhered to the inner wall of the blood vessel outside of the body by means of the balloon. The thrombus pieces that leak out from between the balloon and the inner wall of the blood vessel when removing the thrombus flow downstream, pass through the course-mesh filter, and are caught by the *course-mesh [typo: should be fine-mesh]* filter. After the thrombus is removed outside of the body by the balloon, first, the balloon is deflated, then the tube is advanced so that it comes into contact with the filter, the wire is pulled so as to house the filter inside of the tube and when the tube is retracted outside of the body, the thrombus pieces that were caught by the filter are removed.

[0006]

[Embodiment]

Below is provided an explanation of an embodiment of the thrombus-removing catheter pertaining to the present invention with reference to the drawings. Fig. 1 is a partial cutaway side view of the relevant parts of the thrombus-removing catheter with the balloon in a deflated state and the filter housed in the tube. Fig. 2 is a partial cutaway side view of the relevant parts of the thrombus-removing catheter with the balloon in the inflated state and the filter pushed out from the tube in the forward direction. In Fig. 1, the thrombus-removing catheter is provided with a balloon catheter comprised of a flexible tube 1 and an inflatable/deflatable balloon 2 provided on the outer surface near the distal end of said tube, wherein said balloon catheter is provided with a self-expanding filter 3 that can be housed inside of said tube 1. The distal end of said filter 3 is connected to a semispherical member 4 that faces outward toward the maximum diameter, which is the same as the inner diameter of said tube 1 and the proximal end of said filter 3 is connected to a flexible wire 5 that is inserted into said tube. Said filter 3 comprises a fine-mesh filter 31 that forms a convex shape toward its distal end and a course-mesh filter 32 that is connected to the proximal end of said fine-mesh filter *32 [typo: should be 31]* at a point where the diameter is the

greatest. As shown in Fig. 2, said self-expanding filter 3 is pushed out from the distal end of said tube 1 and expanded so that it comes into contact with the inner wall of the blood vessel (not shown in the drawing) by advancing said wire 5 forward using said tube 1 as a basis. Flexible tube 1 is a plastic tube, for example, that is commonly used in catheters. Inflatable/deflatable balloon 2 is made of natural rubber that has superior biocompatibility, and tube 1 is inflated by injecting a saline solution, for example, from a port (not shown in the drawing) linked to the inner wall thickness of tube 1 via a lumen, also not shown in the drawing, and is also deflated by discharging the saline solution. Semispherical member 4 that faces outward toward the maximum diameter, which is the same as the inner diameter of said tube 1 is made of a plastic material that has superior blood compatibility, such as silicone. The base material for self-expanding filter 3 should preferably be made of a nylon mesh material such as elastic mesh 30 that is entirely spherical or elliptical in shape. For fine-mesh filter 31, half of the inner surface of the distal end of mesh 30 could be filled with an ultrafine plastic fiber that has superior biocompatibility, such as polyester fiber, or the front half of mesh 30 could be soaked in polymer fluid and hardened to form a membrane filter on the front half of said mesh. Course-mesh filter 32 is actually constituted of the rear half of course mesh 30. Flexible wire 5 is made of stainless steel, or the like. As shown in Fig. 1, the thrombus-removing catheter pertaining to the present invention is inserted into the blood vessel with filter 3 housed inside of tube 1. When it is inserted, semispherical member 4 closes the distal end of tube 1 to prevent blood from leaking from tube 1 to the outside of the body. Fig. 2 shows filter 3 being pushed out from the distal end of tube 1 by advancing wire 5 so as to inflate the balloon, and since filter 3 is a self-expanding filter, it expands and comes into contact with the inner wall of the blood vessel, which is not shown in the drawing, and as described above, balloon 2 is inflated by injecting a saline solution so that it also comes into contact with the inner wall of the blood vessel. Either the pushing out of filter 3 or the inflating of balloon 2 can be performed first. The thrombus-removing catheter into which is inserted the self-expanding filter pertaining to the present invention is either inserted into the blood vessel in which a thrombus has adhered to its inner wall, balloon 2 is inflated, the wire is then advanced and the self-expanding filter is retracted from the distal end of the balloon catheter, or self-expanding filter 3 is retracted before balloon 2 is inflated so that balloon 2 and self-expanding filter 3 both come into contact with the inner wall of the blood vessel. If the thrombus-removing catheter pertaining to the present invention is gradually retracted with balloon 2 and self-expanding filter 3 touching the inner wall of the blood vessel, the thrombus is removed to the outside of the body by balloon 2, the small amount of thrombus pieces that leak out from between balloon *3 [typo: should be 2]* and the inner wall of the blood vessel pass through course-mesh filter 32, are caught due to the sliding that takes place between the portion of fine-mesh filter 31 where the diameter is the greatest and the inner wall of the blood vessel and are discharged from the body. Or, self-expanding filter 3 is placed in accordance with the state of the blood vessel and left so that it is touching the inner wall of the blood vessel and then tube 1 is retracted so as to remove the thrombus adhered to the inner wall of the blood vessel outside of the body by means of balloon *3 [typo: should be 2]*. The thrombus pieces that leak out from between balloon *3 [typo: should be 2]* and the inner wall of the blood vessel when removing the thrombus, flow downstream, pass through course-mesh filter 32, and are caught by fine-mesh filter 31. After the thrombus is removed outside of the body by the balloon, first, balloon *3 [typo: should be 2]* is deflated, then tube 1 is advanced so that it comes into contact with filter 3, wire 5 is pulled so as to house filter 3 inside of the catheter and when tube 1 is retracted outside of the body, the thrombus pieces that were caught by filter 3 are also

removed.

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[Effect of the Invention]

Since the thrombus-removing catheter pertaining to the present invention has the aforementioned constitution, the thrombus pieces that leak out from the area around the balloon can be completely caught and discharged from the body.

[Brief Explanation of the Drawings]

[Fig. 1]

A partial cutaway side view of the relevant parts of the thrombus-removing catheter with the filter housed inside the tube.

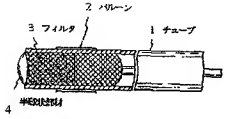
[Fig. 2]

A partial cutaway side view of the relevant parts of the thrombus-removing catheter with the balloon in the inflated state and the filter pushed out from the tube in the forward direction.

[Explanation of the Reference Symbols]

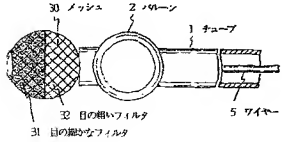
1 is the tube, 2 is the balloon, 3 is the filter, 4 is the semispherical member, 5 is the wire, 30 is the mesh, 31 is the fine-mesh filter, and 32 is the course-mesh filter.

[FIG. 1]



1= tube; 2= balloon; 3= filter; 4= semispherical member

[FIG. 2]



1 = tube; 2 = balloon; 5 = wire; 30 = mesh; 31 = fine-mesh filter; 32 = course-mesh filter